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ABSTRACT

The U.S. Department of Agriculture's (USDA) farm real estate value index is currently constructed with a modified Laspeyres weighted average formula, with the acreage weights changed approximately every 10 years. An analysis of acreage weights from 1974, 1978, and 1982 census data revealed, however, that substantial changes in real estate values at the state level had occurred within the time period studied. The current formula for determining farm real estate value indexes would improve if a more frequent weighting scheme were used. Updating the acreage weights every 5 years instead of every 10 years would better represent current land use patterns and provide more consistency with the USDA dollar value farm real estate series. Two ways of improving the USDA indexing methods are possible--altering the modified Laspeyres formula or switching to a Divisia formula. The modified Laspeyres formula with weights updated every 5 years is recommended because it is more understandable to users, whereas the statistical benefits of the Divisia formula are uncertain for a farm real estate value index. A table is provided that shows that when the 1984-1985 percent change estimates are weighted with 1974, 1978, and 1982 census estimates for land in farms the estimates for the lower 48 states decrease by 14%, 14%, and 13% for the 3 years, respectively. (MN)

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Alternative Ways to Index Farm Real Estate Values

Catherine Greene
Charles Barnard

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Abstract

The current (modified-Laspeyres) formula for determining farm real estate value indexes would improve through using a more frequent weighting scheme. Updating the acreage weights every 5 years instead of every 10 years would better represent current land-use patterns and provide more consistency with the U.S. Department of Agriculture's (USDA) dollar-value farm real estate series. This report examines two ways of improving USDA's indexing methods: altering the modified-Laspeyres formula or switching to a Divisia formula. The modified-Laspeyres formula with weights updated every 5 years is recommended because it is more understandable by users, while the statistical benefits of the Divisia formula are uncertain for a farm real estate value index.

Keywords: Divisia, Laspeyres, farm real estate value index, weights, State, national.

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Summary

The current (modified-Laspeyres) formula for determining farm real estate value indexes would improve through using a more frequent weighting scheme. Updating the acreage weights every 5 years instead of every 10 years would better represent current land-use patterns and provide more consistency with the U.S. Department of Agriculture's (USDA) dollar-value farm real estate series. This technical report examines two ways of improving USDA's indexing methods: altering the modified-Laspeyres formula or switching to a Divisia formula. The modified-Laspeyres formula with weights updated every 5 years is recommended because it is more understandable by users, while the statistical benefits of the Divisia formula are uncertain for a farm real estate value index.

Weighted average formulas are used to construct most of the indexes produced by the Federal Government. These formulas are distinguished by the type of weights used and the frequency with which they are changed. Index prices may be weighted according to the relative importance of their components in the base year (Laspeyres method and Divisia method), or in the current year (Paasche method). The "classic index number problem" arises from the choice between weighting prices according to the relative importance of components in a base year versus the current year.

The Paasche method cannot be used because acreage weights are not available on an annual basis. The Divisia method and the modified-Laspeyres method with more frequently changed weights are both better alternatives for calculating USDA's farm real estate value index. Since acreage weights changed enough over time to cause differences in the index to exist, updating the weights every 5 years could improve USDA's index. Users can easily relate to a weighting scheme where values are weighted directly by acres and where a one-to-one correspondence exists between acres and weights. The problem of weights becoming unrepresentative over time would be mitigated, and the index would be more consistent with USDA's other major farm real estate value series.

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Alternative Ways to Index Farm Real Estate Values

Catherine Greene
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Introduction

Accurately portraying changes in farm real estate values has become critical during the current farm financial crisis. Studies on farm real estate values have employed many methods, from correlation analysis in the twenties and thirties (*3, 7, 11*), to multiple equation regression and maximum bid models in recent years (*18*).[1] This report attempts to present the best method for indexing changes in farm real estate values, and examines the issues involved in constructing an index.

While previous studies have focused on the possible use of hedonic indexing (*19*) and on the best type of data to use (*20*), studies of urban real estate value indexes have involved a much broader range of issues. These issues include alternative methods (*15*), index number theory (*8*), land classification and index design (*16*), land quality indexing (*13*), hedonic indexing (*9, 17*), and data types (*4*). Many of these issues are pertinent for indexing farm real estate values, particularly the issue of choosing the best indexing method.

Since 1926, the U.S. Department of Agriculture (USDA) has calculated and published the most widely used index of State and national changes in farm real estate values. Since that time, the method used to calculate this index has not changed, although there have been many developments in indexation theory. This study examines alternatives for improving USDA's index by using different indexing methods. The following section reviews alternative indexing methods and their procedures. These methods include the popular Paasche and Laspeyres weighted-average formulas and the recently proposed Divisia formula. Both the Paasche and Laspeyres methods involve the "classic index number problem," which results in the choice between weighting prices according to the relative importance of components in a base year versus the current year. However, the Divisia method overcomes this problem and has recently been implemented for economic aggregates published by several Government offices (*1, 2*).

USDA currently uses the modified-Laspeyres method to calculate the farm real estate value index. We describe the steps in calculating this index and compare two alternative methods with the current method. An alternative form of the modified-Laspeyres method is calculated for the 1984-85 State-level percentage changes in values. A national-level Divisia index is calculated for the 1970-85 percentage changes. The alternative modified-Laspeyres index and the Divisia index showed small differences from USDA's published index. These alternatives are more consistent with the USDA dollar-value farm real estate series and are based on more representative land-use patterns.

Indexation Methods

Several approaches are used to construct price indexes, including calculating with weighted-average formulas and hedonic regressions (a relatively new approach). Hedonic indexes are one of the major applications of Lancaster's characteristics theory of consumer demand which says that consumers demand characteristics of products rather than the products themselves (*14*). With this approach, a regression equation is used to estimate the prices of relevant characteristics, which are then used with quantity weights to construct a weighted-average index. Alternatively, a regression equation can be used

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[1]Italicized numbers in parentheses refer to references listed at the end of this report.

to estimate price changes directly from time variables specified in the model to create a hedonic-price index (*10*). Most of the empirical work on hedonic price indexing has been for consumer goods such as automobiles, tractors, and houses. However, several recent studies have created a hedonic-price index of residential land (*9, 17*) and a hedonic-farm real estate value index (*20*). Unlike weighted-average methods, hedonic indexing accounts for quality changes over time and eliminates the problem of whether to use current- or base-period weights. However, the hedonic approach requires more detailed data than do other methods. Thus, its use is limited for USDA's State and national farm real estate value index and other indexes for which only county-level data are available.

The Federal Government uses weighted-average formulas to construct virtually all the indexes it produces. These formulas are distinguished by the type of weights that are used and the frequency with which they are changed. Prices may be weighted according to the relative importance of their components in the base year, in the current year, or in some moving-base year. If the relative quantities of each component in an index do not change over time, then the same index numbers would result from both a base-weighted and a current-weighted formula. However, the relative proportion of components usually does change over time, due to changes in income, preference changes, or substituting between components in response to relative price changes. For example, the components of the Consumer Price Index may change over time because consumers substituted one food item for another in response to a price increase in one item. These changes can cause index numbers, based on different formulas, to diverge.

The most commonly used weighted-average methods are the Laspeyres and Paasche methods. The modified versions of these methods are called chain-Laspeyres and chain-Paasche. A Laspeyres index compares current prices with prices in a base period by using base-period quantities for aggregation. The Laspeyres price index formula is:

$$P_L = \left(\frac{p_i q_o}{p_o q_o}\right) 100, \qquad (1)$$

where p_o is a price in the base year, p_i is a price in the given year, and q_o is a quantity in the base year (*5*). An advantage of the Laspeyres index is that only pure price changes are measured. Results from changes in the relative importance of components (the acreage in each district, State, and type of farmland in the farm real estate value index) are not reflected in the price index. The disadvantages are that over time, the base-period weights may become unrepresentative of the current pattern of land use. USDA's farm real estate value index is a modified-Laspeyres index, where the weights are held constant for some period of years and then changed.

A Paasche index uses current-period weights to compare current prices with base-period prices. The Paasche price index formula is:

$$P_P = \left(\frac{p_i q_i}{p_o q_i}\right) 100, \qquad (2)$$

where p_o is a price in the base year, p_i is a price in the given year, and q_i is a quantity in the current year. The advantage of the Paasche index is that over time weights do not become unrepresentative. However, intermediate year comparisons cannot be made because an annual index needs annual data. The weights used for calculating USDA's farm real estate value index are taken from the census of agriculture, which is published every 4 or 5 years. No other sources of sub-State acreage weights are available. Thus, due to limited data, a land value index using either the Paasche or modified-Paasche formula could not easily be constructed.

The economic interpretation of Paasche and Laspeyres and other weighted-average price indexes is based on consumer-demand theory. This interpretation assumes that specified utility-maximizing consumers have a fixed budget and unchanging indifference map for the commodities in the price index. The fixed-base or Laspeyres index measures the changing cost of this fixed and specific budget from one time period to another. These indexes measure the changing cost of a bundle of commodities represented by the base-period preferences, or the original point on a constant-utility curve on a specified consumer's indifference map. Thus, the Laspeyres index measures only pure price changes because it does not reflect changes which occur over time if the quantity weights or preferences change. However, the Paasche index shows the changing cost of the bundle of goods at the current point on the indifference curve. If preferences change considerably from the base period to the current period, then the Paasche index can be smaller than the Laspeyres index because it accounts for substitution.

The Laspeyres and Paasche methods monitor either price changes or quantity changes, but not both. However, we need to monitor both changes simultaneously since prices and quantities are causally

related. The continuous Divisia-Integral index, described early in the century, was designed to take this correlation into account. Although this continuous formula has not been useful for indexing discrete prices and quantities, a recently proposed discrete approximation to the Divisia-Integral index is useful (*21*). The superior statistical properties of the discrete Divisia index have been described in several articles (*6, 12*). One particularly important property, in contrast with other indexes, is that the Divisia index is consistent with a flexible functional form for the underlying utility or production aggregator functions. The Laspeyres and Paasche indexes are consistent with only very restrictive functional forms for the aggregator function (*6*). Recent applications of the Divisia method include construction of a Divisia quantity index of monetary services and the use of the Divisia indexing method to estimate total factor productivity in the agricultural sector (*1, 2*).

The Divisia index defines the single-period aggregate price change as the weighted sum of the growth rates of the component prices. The weights are constructed by averaging the relative share of total expenditure of a given component in the current time period with its share in the previous time period. The commonly used formula for the discrete approximation of the Divisia-price index is:

$$\log P_t - \log P_{t-1} = \sum_i^n 1/2[W_{i,t} + W_{i,t-1}][\log(p_{i,t}) - \log(p_{i,t-1})],$$

$$\text{where } W_{i,t} = \frac{p_{i,t}q_{i,t}}{\sum_i^n p_{j,t}q_{j,t}} \quad (3)$$

$(i = 1 \ldots n)$
$(j = 1 \ldots n),$

and $p_{i,t}$ and $q_{i,t}$ are the associated sets of observations for prices and quantities, $W_{i,t}$ represents the weights, j represents index components, and t represents time.

The economic interpretation of the Paasche, Laspeyres, and Divisia formulas is based on production and consumer-demand theory and relies on generally accepted assumptions about production and consumption, and about producer and consumer behavior associated with this theory. However, farm real estate is neither a typical shortrun variable input nor a Marshallian commodity. It has few buyers and sellers. Parcels are heterogeneous and have a fixed location. The economic motivations for purchasing and selling farm real estate may be quite different from those typically assumed for producers and consumers in standard microeconomic theory. Thus, choosing a particular formula for the farm real estate value index based on the formula's economic interpretation is weak.

USDA's Farm Real Estate Value Index

Currently, a modified-Laspeyres weighted-average method is used to construct USDA's State- and national-level farm real estate value index. This index is based on value data from USDA's annual survey of farmers,[2] and on estimates of land in farms from the quinquennial census of agriculture. USDA's survey provides county-level value estimates for dry and irrigated cropland, pastureland, and woodland. The first step in creating the State-level index is to calculate district averages of each type of farmland for each of the typically 8 to 10 districts per State. The second step is to weight these district averages up to the State level based on the proportion of acreage in each of the districts.

After weighting estimates up to the State level, these estimates are then weighted by the proportion of acreage in each type of farmland to obtain a State average of all farmland. The final step divides the current period's weighted State averages by the base period's (currently 1977) weighted State averages to derive the index numbers of change in farmland value since the base period.[3] The averages of all farmland in each State are weighted up to the national level based on the proportion of total acreage in each State. The State- and national-level farm real estate value indexes are modified-Laspeyres indexes in that acreage weights are changed periodically instead of being held indefinitely constant.

In 1926, the original pupose for initiating the farm real estate value index was to allow better comparison among States by using index numbers instead of absolute values, and to minimize confusion between the farmland values series based on census data and the series based on USDA's survey data (*22*). Initially, both a weighted and an unweighted index were published. There was also some experimentation with the categories for which farmland values were elicited; asking for the average value of poor, average, and good plowland was rejected in favor of asking for the average value of the more familiar concept of all farmland with improvements. However, from 1926 to the present, calculating the farm real estate value index has continued with very few changes.

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[2]USDA's Agricultural Land Value Survey is a stratified probability survey. Counties have been stratified into rural, urban, and urban-fringe districts based on county population and other urban-influence variables, and on geographic characteristics.

[3]Changing the base period does not change the index.

Divisia and Modified-Laspeyres Indexes

The components used to weight an index invariably change over time. Differences in farm real estate index numbers calculated with the Paasche, Laspeyres, Divisia, and other weighted-average formulas are due primarily to these changes in the weights. The modified-Laspeyres formula with infrequently changed weights has been used since 1926 to calculate the farmland value index. Even though the census data used for the acreage weights are available every 4 or 5 years, the weights are usually held constant for approximately 10 years, or for as long as 25 years. Although the Paasche formula cannot be used because acreage weights are not available annually, either the Divisia formula or the modified-Laspeyres formula with more frequently changed weights are alternate choices for calculating USDA's farm real estate value index. Updating weights more often in the farm real estate value index mitigates the problem of weights becoming unrepresentative over time.

This section desribes how the acreage weights have changed from 1974-82 (the latest available estimates). Then, modified-Laspeyres index numbers constructed with different weights are compared with each other, and a Divisia index is compared with the published modified-Laspeyres index. The modified-Laspeyres formula is used to calculate 1984-85 percentage-change estimates for State and national farm real estate values. Census estimates of dry and irrigated cropland, grazing land, and woodland in 1974, 1978, and 1982 are used as the weights in these alternative base-period indexes. Divergence in these indexes is due to the changes in acreage weights from 1974-82. A single-Divisia index of the percentage change in national values from 1970-85 is also constructed using the Divisia formula. A State-level Divisia index was not constructed due to data limitations.

Table 1 shows the changes in the State-level acreage weights that occurred over the last three census periods (1974, 1978, and 1982). The relative proportion of acreage in dry and irrigated cropland, grazing land, and woodland did not change dramatically during these census periods. The most prominent change was a decrease in the proportion of grazing lands in a majority of the States. Grazing land as a proportion of the State total farmland acreage decreased by 7 or more percentage points between 1974-82 in Vermont, Idaho, Montana, and California. The proportion of woodland acreage increased in the majority of States between 1974-82, with the largest increases in the Northeast. Woodland acreage in Connecticut, New Hampshire, and Rhode Island increased by 8, 10, and 13 percentage points. Although there were no increasing or decreasing trends between 1974-82 for the dry and irrigated cropland acreage weights, large shifts in acreage in these types of farmland occurred in a few States. For example, between 1974-82, dry cropland increased from 58 to 68 percent of total farmland in Louisiana, and decreased from 57 to 48 percent in Rhode Island.

The modified-Laspeyres indexes calculated with these alternative State-level acreage weights differed depending upon whether the 1974, 1978, or 1982 base weights were used (table 2). Only about 25 percent of the States showed more than a 2-percentage-point difference between estimates calculated with the three different sets of weights. However, there was considerable divergence in some of these States. Arizona would have shown a 28-percent increase using 1974 weights compared with the 10-percent increase calculated with 1982 weights. New Mexico would have shown a 12-percent increase using 1974 weights compared with the 22-percent increase calculated with 1982 weights. Other States which would have diverged more than 2 points using a different set of weights include Colorado, Georgia, Nevada, New Hampshire, New Jersey, Rhode Island, Texas, Washington, West Virginia, and Wyoming. The national decrease in farmland value from 1984 to 1985 was 13 percent using 1982 weights, compared with 14 percent using either 1974 or 1978 weights.

The Divisia index of national-farm real estate values is constructed somewhat differently than the modified-Laspeyres index. The acreages of each type of farmland in each district and State (components of the modified-Laspeyres index) are used directly as the weights in this type of index. However, the weights in the Divisia index are a 2-year moving average of each component's share of total expenditures. Acreage is multiplied by the price of a given component and divided by the sum of the value of all components to derive the market share of that component. Figure 1 shows both a national-level Divisia farm real estate value index and the published USDA farm real estate value index for 1970-85. The indexes are very closely matched despite differences in weighting schemes. There is only a 1-percentage-point difference between the two indexes in any year. The Divisia index is 1 point higher in 1970-74, 1976, 1980, and 1984-85, and is 1 point lower in 1980. There is no difference at all between the two indexes in the other 5 years.

Table 1—Proportion of acreage in dry cropland, irrigated cropland, grazing land, and woodland in 1974, 1978, and 1982, by region and State

Region and State	Proportion of total farmland acres											
	Dry cropland			Irrigated cropland			Grazing land			Woodland		
	1974	1978	1982	1974	1978	1982	1974	1978	1982	1974	1978	1982
	Percent											
Northeast:												
Connecticut	57	54	55	2	2	0	18	14	13	23	30	31
Delaware	79	78	83	3	5	0	3	2	3	14	14	14
Maine	47	46	45	0	0	0	11	8	9	41	46	46
Maryland	73	73	74	0	1	1	10	9	7	17	18	18
Massachusetts	47	48	48	4	2	2	15	12	12	34	38	39
New Hampshire	39	37	35	1	0	0	18	12	12	43	51	53
New Jersey	67	69	73	12	8	6	7	7	6	13	16	15
New York	67	67	67	1	1	0	18	15	14	14	18	19
Pennsylvania	71	71	71	0	0	0	13	11	11	15	18	18
Rhode Island	57	51	48	5	4	4	14	10	12	24	35	37
Vermont	50	51	51	0	0	0	24	17	17	26	31	32
Lake:												
Michigan	82	81	82	1	2	2	7	6	5	10	11	11
Minnesota	85	85	86	0	1	1	10	9	9	4	5	5
Wisconsin	72	71	72	1	1	1	16	14	13	11	13	14
Corn Belt:												
Illinois	89	89	90	0	0	0	7	6	6	4	4	4
Indiana	85	85	86	0	0	0	8	7	6	7	8	7
Iowa	89	90	90	0	0	0	10	8	8	1	2	2
Missouri	70	70	69	0	1	1	24	22	23	6	7	8
Ohio	83	81	82	0	0	0	10	10	9	7	9	9
Northern Plains:												
Kansas	62	59	66	4	6	5	34	35	29	1	1	1
Nebraska	41	37	40	7	12	14	51	50	46	0	0	0
North Dakota	74	71	75	0	0	0	25	28	24	1	0	0
South Dakota	46	43	46	0	1	1	53	56	53	0	0	0
Appalachia:												
Kentucky	68	68	65	0	0	0	19	16	16	13	16	17
North Carolina	56	58	61	0	1	1	14	12	11	29	30	28
Tennessee	65	65	65	0	0	0	20	18	18	15	17	17
Virginia	49	50	51	0	0	0	26	24	23	24	26	26
West Virginia	37	40	39	0	0	0	38	34	33	25	26	28
Southeast:												
Alabama	47	51	52	0	0	0	31	26	25	22	23	23
Florida	17	24	23	13	11	12	63	58	58	7	7	7
Georgia	50	51	53	1	3	3	22	17	17	28	29	28
South Carolina	57	58	59	0	0	0	17	14	12	25	28	28
Delta:												
Arkansas	67	64	61	5	8	11	20	20	19	8	9	9
Louisiana	58	66	68	9	7	5	24	19	18	9	9	10
Mississippi	61	64	64	1	1	2	26	21	20	12	15	15
Southern Plains:												
Oklahoma	43	42	46	2	2	1	54	55	51	2	1	2
Texas	22	25	27	5	5	4	73	70	67	1	1	1
Mountain:												
Arizona	1	1	1	6	3	3	93	96	96	0	0	0
Colorado	19	23	21	8	8	10	72	69	68	1	1	1
Idaho	26	25	23	3	2	4	80	73	73	0	0	0
Montana	16	24	23	3	2	4	80	73	73	0	0	0
Nevada	0	2	2	11	6	12	89	92	86	0	0	0
New Mexico	3	3	2	2	2	2	95	95	96	0	0	0
Utah	5	11	8	11	8	12	83	80	79	0	1	0
Wyoming	4	5	4	5	3	5	91	92	91	0	0	0
Pacific:												
California	8	12	10	25	25	30	66	62	58	1	1	2
Oregon	20	21	21	9	8	11	68	68	64	2	3	3
Washington	48	42	42	10	9	11	40	47	44	2	2	3

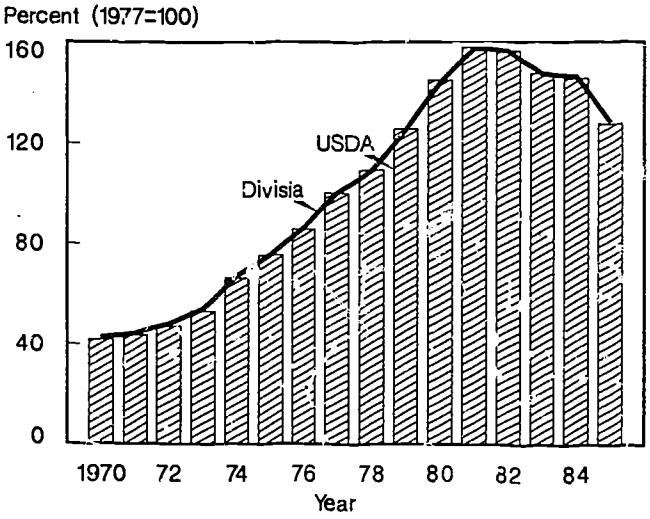
Sources: 1974, 1978, and 1982 Censuses of Agriculture.

Table 2--Farm real estate values: 1984-85 percentage-change estimates weighted with 1974, 1978, and 1982 census estimates for land in farms

Region and State	Change in value, 1984-85		
	1974 weights	1978 weights	1982 weights
		Percent	
Northeast:			
Connecticut	29	30	16
Delaware	-13	-12	-13
Maine	-22	-22	-26
Maryland	8	7	8
Massaschusetts	26	26	26
New Hampshire	16	18	20
New Jersey	5	7	9
New York	-4	-4	-4
Pennsylvania	4	4	4
Rhode Island	-7	-9	-9
Vermont	-8	-8	-8
Lake:			
Michigan	-13	-14	-14
Minnesota	-23	-23	-24
Wisconsin	-19	-19	-19
Corn Belt:			
Illinois	-27	-27	-27
Indiana	-21	-21	-21
Iowa	-29	-29	-29
Missouri	-23	-22	-23
Ohio	-22	-21	-22
Northern Plains:			
Kansas	-20	-20	-20
Nebraska	-29	-29	-29
North Dakota	-18	-18	-18
South Dakota	-25	-25	-26
Appalachia:			
Kentucky	-11	-10	-10
North Carolina	-11	-10	-10
Tennessee	-7	-6	-6
Virginia	-2	-2	-2
West Virginia	-15	-15	-19
Southeast:			
Alabama	-12	-11	-11
Florida	-9	-10	-10
Georgia	-7	-4	-5
South Carolina	-3	-3	-3
Delta:			
Arkansas	-10	-10	-9
Louisiana	-7	-7	-7
Mississippi	-11	-11	-11
Southern Plains:			
Oklahoma	-19	-19	-19
Texas	-8	-10	-10
Mountain:			
Arizona	28	12	10
Colorado	-7	-9	-7
Idaho	-8	-9	-8
Montana	-16	-17	-16
Nevada	-25	-19	-24
New Mexico	12	25	22
Utah	-15	-16	-14
Wyoming	-24	-23	-28
Pacific:			
California	-59	-58	-60
Oregon	-17	-17	-17
Washington	-6	-2	-4
48 States	-14	-14	-13

Sources: 1974, 1978, and 1982 Censuses of Agriculture and the 1985 and 1986 Agricultural Land Value Surveys.

Farm real estate value indexes:
USDA and Divisia indexes



Although the Divisia index and modified-Laspeyres index with infrequently changed weights are nearly identical at the national level, there are probably larger differences at the State level. The weights in the Divisia index would be updated every 5 years, when data become available. In contrast, they are held constant for approximately 10 years in the published USDA index. The comparison above of 1985 modified-Laspeyres index numbers with weights held constant for different lengths of time also showed only a 1-percentage-point difference at the national level, but a more substantial difference at the State level.

Changing the weights every 5 years would improve USDA's modified-Laspeyres index for several reasons. First, changing the acreage weights more frequently mitigates the problem of them becoming unrepresentative of current land-use patterns. Second, changing the weights every 5 years would make the resulting index numbers more consistent with another major farm real estate value series published by USDA, also based on quinquennial census data.[4] The weights could be updated every 5 years either by altering the modified-Laspeyres formula currently used or by switching to the Divisia formula.

[4]USDA also publishes a dollar value series of farm real estate based on census of agriculture data. This series is updated between census years by using interpolations and extrapolations based on USDA's farm real estate value index.

Conclusions

USDA's farm real estate value index is currently constructed with a modified-Laspeyres weighted-average formula, with the acreage weights changed approximately every 10 years. An analysis of acreage weights from 1974, 1978, and 1982 censuses revealed substantial changes over time at the State level. There were also large differences at the State level between USDA's 1984-85 farm real estate value index based on the older weights and the recalculated index based on the more recent weights. Thus, updating the weights every 5 years would improve USDA's index, since the weights changed enough over time to alter the index. Two choices are available for implementing the more frequent weighting scheme: altering the modified-Laspeyres formula or switching to a Divisia formula.

The statistical qualities of the Divisia formula, based on production- and consumer-demand theory, are superior to the modified-Laspeyres formula. The Divisia formula accommodates the correlation between prices and quantity weights, allowing for consistency with more flexible forms of the underlying aggregator function. However, since land is neither a typical shortrun variable input nor a Marshallian commodity, these superior qualities of the Divisia formula may be irrelevant for calculating a farm real estate value index.

The modified-Laspeyres formula has more appealing characteristics than the Divisia formula when considering the users of the index. Users can relate easily to a weighting scheme in which values are weighted directly by acres, and where a one-to-one correspondence exists between acres and weights. The Laspeyres formula uses this direct weighting scheme, but the Divisia formula uses a 2-year moving average of total value as weights. Weighting by the total value of farm real estate rather than by acreage is a much less intuitive concept. Consequently, since the modified-Laspeyres formula is more understandable by users and the statistical benefits of the Divisia formula may be irrelevant, the modified-Laspeyres formula with weights updated every 5 years is recommended for calculating USDA's farm real estate value index.

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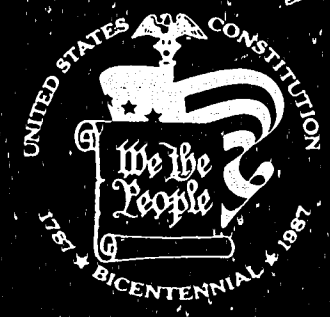

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